No. XI.

EXPANDING PISTON.

The LARGE SILVER MEDAL *and* TWENTY POUNDS *were presented to Mr.* ROBERT MOTTERSHEAD, *for his Expanding Piston for High-pressure Steam-Engines; a Model of which has been placed in the Society's Repository.*

FOR low-pressure engines, cotton packing is sufficient to prevent the steam from escaping between the piston and the sides of the cylinder. But in high-pressure engines, the heat and elasticity of the steam are such as to destroy the accurate fitting of the cotton packing, and thus to necessitate its renewal at inconveniently short intervals.

Expanding pistons, composed entirely of metal, have accordingly been suggested, have been the subject of patents, and have been brought more or less into use. In one of the best of these the circumference is divided into segments, between every two of which is a triangular wedge, having its point towards the circumference, and its base towards the centre. Each of these wedges is backed by a strong spring, the tendency of which is to force outwards the point of the wedge, and consequently the segments against which it bears. But, in practice, the point of the wedge has been found very liable to mark, and finally to score and destroy the cylinder, against the sides of which it is continually

pressing with a force greater than that exerted by the segments.

Mr. Mottershead's piston is composed of two layers, each of which consists of six segments; of these, three alternate ones are pinned so as to form immovable abutments for the support of the three movable ones which are curved internally, and have each a strong spring, placed like a bowstring across the internal curve, and bearing against the sides of a cylindrical core that fills up the inside of the piston. Hence it is evident that these movable segments are continually pressed outwards by the action of their respective springs. The movable segments occupy a little larger part of the exterior curvature than the fixed ones do; and therefore, by so placing the two layers of segments that the three movable ones in the upper layer shall correspond with the three fixed ones in the lower layer, an expanding piston is produced, every part of which that touches the cylinder is a segment of a circle of the same magnitude as the cylinder itself, and, while it prevents the escape of steam, has no sensible wearing on the sides of the cylinder.

Messrs. Hefford and Thomas, engine makers, in whose employ Mr. Mottershead is, have made trial of one of his expanding pistons for the last seven months; the inside of the cylinder was found, at the end of that time, not to be in the least degree scored or marked, but retained its polish perfectly. It works without oil, and has been proved by a water pressure of 700 lbs. on the inch. The composition of which the piston is made is bronze, consisting of seven parts copper and one part tin. Three other engines have more recently been fitted up by the same makers with Mr. Mottershead's expanding piston.

Reference to the Engraving, Plate VI.

The expanding circumference of this piston is divided into six segments, which alternately over and under-lap each other, thereby securing a sufficiently equal pressure all round against the cylinder. Fig. 8 is an elevation, and fig. 9 a plan, of the piston complete; it is formed in two halves or layers, exactly alike, each containing three sliding segments: they are bound on the piston-rod *c* by the shoulder *d* and the screwed nut *e*. Fig. 10 shews one, the lower half, complete; *m m m* are the fixed parts, and *f f f* the three sliding segments, backed and protruded by the springs, *g g g*. Fig. 11 is the upper half without the sliding segments, *i i i* being the three places in which they slide: near one end of each, at *j j j*, are lengthened holes to receive the pins *k k k*, fig. 10, of the sliding pieces, and limit their motion; one is shewn in the elevation of a sliding piece, fig. 12. These pins also prevent the segments from falling or being pushed out by their springs farther than is shewn in figs. 8, 9, and 10, at the same time that they allow them to be pressed in flush with the diameter of *a* and *b*, so as to enter the cylinder. Fig. 13 is one of the sliding pieces *h* separate; fig. 14 its spring, which is nearly as deep as the segments are thick. The three abutments, or filling pieces *l l l*, between which the segments slide, are screwed on to the part *a*, and three more *m m m* on the part *b*, with one screw and two steady pins to each. Fig. 15 is a section of the part *b*, without the filling pieces *m*; *n* is a cavity which, in the part *a*, receives the shoulder *d*, and, in the part *b*, the screw nut *e* of the piston rod: *o* is a hole in part *b*, to receive a steady pin *p*; these, on the part *a*,

are so placed as to cause the sliding pieces of one part to lie over the filling-pieces of the other, and thus form a continued yet sliding band of metal round the piston. The points of the screws and heads of the steady pins in the filling pieces, and the edges of the springs *g*, are purposely kept a little below the surface, to prevent them from coming in contact with the opposite sliding pieces. Before the springs *g* are put in, the segments *f* and *h* are pushed in flush with *a* and *b*, and bound fast; the whole is then turned in the lathe together as one cylinder. The sliding and the filling pieces are perfectly flush or even with each other; but the circular prominences marked *a* in fig. 11, and *b* in figs. 10 and 15, project in the least possible degree beyond the segments, so that, when all the parts are bound together, the sliding pieces have just room, and no more, to move easily.

No. XII.

TURNING LATHE.

The GOLD ISIS MEDAL *was presented to Mr.* JAMES CLEMENT, 21, *Prospect Place, Southwark, for his improved Turning Lathe.*

IT is almost unnecessary to state, that persons who have been in the habit of turning different kinds of metal must be aware, that if it passes the tool at too great a velocity, it will soften and grind away the tool; consequently,